ORTHODONTIC TOOTHBRUSH

BACKGROUND OF THE INVENTION

This invention relates generally to toothbrushes, and specifically to toothbrushes for use by wearers of various orthodontic devices such as braces.

Considerable difficulty has been encountered by wearers of orthodontic devices in keeping the teeth clean and free from plaque by brushing with conventional toothbrushes. It is difficult to apply enough pressure to overcome the impeding effect of the braces without injuring the gums and to obtain thorough access to all of the exposed tooth surfaces with the conventional toothbrush bristles. Sufficient pressure must be applied to the bristles so as to reach behind the brace elements. Furthermore, the presence of braces require a back and forth brushing motion which creates undue pressure, thus tending to result in pyorrhea. A toothbrush which meets the above-noted challenges is shown and described in Pavone, et al., U.S. Patent 5,325,560.

Pavone, et al. brings forth a toothbrush containing an elongated handle, a neck and a head having a bristle design and pattern which promotes effective brushing of the teeth while minimizing damage to the gums and allows for effective brushing action on all of the tooth surfaces despite the presence of orthodontic devices. The Pavone, et al. toothbrush bristles are designed so that the outermost rows are relatively soft and of long length, the bristles in the pattern gradually shortening in length and becoming stiffer, with the shortest and stiffest bristles being positioned along the center rows of the brush's longitudinal centerline axis. Also, the center rows of bristles are formed to be angled at their ends to reduce the pressure required to deflect the bristles beneath the brace elements thus reducing undue pressure against the gums. Furthermore, a flexible member compressibly supports the center rows of bristles. This reduced pressure avoids the tendency to develop pyorrhea disease.

The Pavone, et al. toothbrush also includes an outer bumper protectively surrounding the toothbrush head and a lower tuft of bristles projecting from the lower portion of the handle. Therefore, the Pavone, et al. toothbrush protects the user's gums but also protects the orthodontic devices.

SUMMARY OF THE INVENTION

The present invention provides an improvement to the Pavone, et al. toothbrush wherein the toothbrush has a neck which is angled and longitudinally flexible with respect to the head and the handle. The toothbrush of the present invention can be utilized with conventional toothbrushes or to maximize its value it can be utilized as a toothbrush made along the lines of that disclosed in the aforementioned Pavone, et al. patent.

The above and other noted features of the present invention are further explained by a review of the accompanying detailed description and accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The objects and features of the invention will become apparent from a reading of a detailed description taken in conjunction with the drawings, in which:

FIG. 1 depicts the toothbrush of the present invention in relation to an orthodontic device and tooth;

FIG. 2 is a side perspective view showing the preferred embodiment of a toothbrush arranged in accordance with the principles of the invention;

FIG. 3 is a side view of the embodiment of FIG. 2;

FIG. 4 is a fragmentary view of the toothbrush head taken from FIG. 2 showing a first embodiment flexible member;

FIG. 5 is a sectional view of the embodiment taken along line 5--5 of FIG. 4;

FIG. 6 is a fragmentary view of the toothbrush head taken from FIG. 2, showing an alternative embodiment flexible member;

FIG. 7 is a sectional view of the alternative embodiment taken along line 7--7 of FIG. 6; and

FIG. 8 is a sectional view of a third embodiment flexible member also taken along line 7--7 of FIG. 6.

FIG. 9 is a side elevational view of a toothbrush made according to the present invention.

FIG. 10 is a partial enlarged side elevational view of a toothbrush according to the present invention in an alternate preferred embodiment illustrating a portion of the handle, the neck and the head.

FIG. 11 is a top elevational view of the toothbrush shown in FIG. 10.

FIG. 12 is a view similar to that of FIG. 10 of an alternate preferred embodiment toothbrush according to the present invention.

FIG. 13 is a top elevational view of the toothbrush shown in FIG. 12.

FIG. 14 is a view similar to that of FIG. 10, being a sectional view of still another alternate preferred embodiment toothbrush according to the present invention.

FIGS. 15 and 16 are sectional views illustrating the operation of fabricating a toothbrush as shown in FIG. 14 with certain items being distorted for purposes of illustration.

FIG. 17 is a view similar to that of FIG. 15 illustrating fabrication operation for manufacturing a toothbrush as shown in FIG. 9 with certain items being distorted for purposes of illustration.

DETAILED DESCRIPTION

FIGS. 2-5 show a toothbrush 10 arranged in accordance with the principles of the Pavone, et al. patent. The toothbrush 10 is used primarily for brushing teeth 11 with orthodontic devices such as braces 12; this is shown in FIG. 1. Referring to FIG. 2, the toothbrush 10 consists of an elongated handle 13, a neck portion 14, and a head 15 positioned thereabove. The head 15 and the neck 14 are preferably angled inward from the handle 13. This allows for easy access to the inside of the teeth 11.

As can be seen in FIGS. 3-5, the head 15 has an inside surface 22 and an outside surface 20, both of which are peripherally surrounded and connected by a sidewall 24. The toothbrush 10 is preferably molded from a polymeric material. Tufts 16 containing a plurality of bristles 18 are molded within the head 15 and project outwardly from the inside surface 22. The bristles 18 are preferably of a nylon material. The tufts 16 of bristles 18 are arranged in a series of rows, thus forming a pattern upon the inside surface 22. The length of the individual bristles 18 gradually vary from a maximum at the outermost rows 18a to a minimum length at the medial rows 18b centrally located therein. Coincidentally, the bristle 18 stiffness is selected to be at a minimum at the outermost rows 18a and gradually increase in stiffness to a maximum toward the center rows 18b. The outer bristles 18a contact with the tooth surface 11 above and below the orthodontic device 12, as well as penetrate the spaces between these devices 12. The shorter and stiffer bristles 18b may become forced into relatively firm pressure against the tooth surfaces overlain by these braces 12. As depicted in FIG. 5, the central two rows of bristles 18b have an angled portion 19 permanently formed inward toward the longitudinal axis or centerline of the toothbrush 10. The base of these central bristles 18b extends perpendicularly from a plane normal to the inside surface 22 of the toothbrush head 15 and the inwardly angled portion 19 begins at a point at least halfway up the bristle. This configuration makes it much easier to deflect the tips of the bristles 18b beneath the brace elements 12 by the application of relatively moderate pressure against the tooth surface 11.

The outermost bristles 18a are mounted perpendicular to a plane 23 (FIG. 3) substantially parallel to the inside head surface 22 and are not angled outward as has been shown in various other patents such as: U.S. Pat. No. 2,797,424, "Toothbrush", to Olson; U.S. Pat. No. 1,901,646, "Toothbrush", to Hicks; U.S. Pat. No. 1,642,465, "Tooth And Massage Brush", to Sheetz; U.S. Pat. No. 890,143, "Brush For Cleaning Artificial Sets of Teeth", to Kuzzer; French No. 1,100,290 to Guzman; and, French 1,057,279 to Grignon. An end plane 50 created by the ends 48 of the outermost bristles is substantially parallel to the plane 23 when observed in the side view, as shown in FIG. 3.

A flexible member 26 comprises a synthetic elastomeric material which retains the centrally located bristles 18b is preferably mounted to the inside surface 22. Flexible member 26 is shown in FIG. 5. The flexible member 26 is comprised of a top surface 28 and a bottom surface 30, both of which are longitudinally bordered and connected by sidewalls 32. The ends of the flexible member 26 are open until located within the head 15. This flexible member 26 serves to form an air pocket 34 therewithin. As can be seen in FIG. 4, this flexible member 26 contains a plurality of holes 36 within its top surface 28. This allows the air 34 to be compressibly released when the central bristles 18b are compressed toward the inside surface 22 of the toothbrush head 15.

Referring to FIGS. 6 and 7, a flexible member 44 is shown. The flexible member 44 is envisioned to be a solid block of spongy material. This material may have voids or air bubbles therewithin. The flexible member 44 has a top surface 46 from which the center rows of bristles 18b extend. The flexible member 44 is bounded by toothbrush head inside walls 52 and is supported by an inside lower wall 51.

FIG. 8 depicts a flexible member 44 whereby a central portion of the head's outside surface 20 is removed therefrom to form an opening. Thus, a bottom surface 48 of the flexible member 44 is visible. Ledges 53 are formed around the opening and are integral with the head's outer surface 20; these ledges 53 serve to support the outermost portions of the flexible member 44 when the flexible member 44 is compressed. Additionally, a transparent polymeric material can be inserted into this central opening to form a transparent window 54.

As is shown in FIGS. 4 and 5, the toothbrush also incorporates a bumper 38 comprising a synthetic elastomeric material which encapsulates a portion of the toothbrush

head 15. The bumper 38 preferably has a cross sectional U-shape with a center portion 40 therein, and having outboard return flange portions 42 thereupon. The center portion 40 is attached to the side wall 24 and the bumper return flanges 42 are attached to the outermost edges of the inside surface 22 and the outside surface 20. The bumper 38 serves to protect the orthodontic devices 12 during normal brushing of the teeth.

Referring to FIGS. 2 and 3, another feature of the toothbrush encompasses a lower bristle tuft 46 molded within the lower end 44 of the toothbrush handle 13. These bristles 46 can be used to brush in tooth crevices behind the orthodontic devices 12. The lower bristles 46 are preferably molded from the same material as the bristles 18 in the head 15.

Referring to Figure 9, a toothbrush 110, according to the present invention has a head 115. The head 115 may be identical to the aforementioned head 15 or can be a head of a conventional toothbrush. The head 115 is generally rigid in its longitudinal direction of extension. The head 115 has bristles 148 which extend in a generally downward direction as shown in Figure 9.

The toothbrush 110 has a neck 114. The neck is flexibly.connected with the head 115 along arrows 117. The neck 114 angularly extends from the head 115 in a direction generally opposite a direction of extension of the bristles 148. A handle 113 is provided. The handle is connected neck 114. The handle 113 is generally rigid in its longitudinal direction of extension. The handle 113 is longitudinally flexibly connected with the neck 114. The handle is provided to allow a teeth cleaning user to manipulate the toothbrush 110 within their oral cavity. The neck 114 is flexible with respect to the head 113 in the longitudinal direction along arrows 119. The toothbrush 110 will typically be connected from a polymeric material. The head 115 and the handle 113 as shown in Figure 9 extend in planes generally parallel to one another.

Referring to Figures 10 and 11, a toothbrush 157 is provided. Toothbrush 157 has a handle 158. Connected to the handle 158 is a neck 160. The neck 160 is connected to a head 162. The neck 160 has on its upper surface 164 and its lower surface 166 a series of grooves 168. The grooves 168 are generally transverse a direction of extension of the neck 160. The grooves 168 add flexure to the neck 160.

Referring to Figures 11 and 12, a toothbrush 187 is provided. The toothbrush 187 has a handle 188 which is similar to handle 158. The handle 188 is connected with a neck 190. The neck 190 is connected with a head 192. The neck 190 has a series of longitudinal grooves or cut-outs 194. The grooves 194 may be provided in a molding operation or may be cut-out from the toothbrush after the material fabricating the toothbrush has formed a permanent set.

Referring to Figure 14, a toothbrush 207 is shown. Toothbrush 207 has a head 208. Flexibly connected to the head 208 is a neck 210. The toothbrush 207 has a handle 212 flexibly connected to the neck 210. The handle 212 has a stiffener 214. The stiffener 214 can be made from a generally rigid solid or hollow member which is fabricated from a polymeric material, wood or other cellulosic materials. In a similar fashion, the neck has a stiffener 216 and the head has a stiffener 218. The stiffeners are encased in a polymeric material 220 which not only provides an outer form for the toothbrush 207 but also performs an adhesive function of connecting the stiffeners 212, 216 and 218 together. The polymeric material 220 can be a nature or synthetic elastomeric material. Depending upon the properties of the material 220, and exterior of the toothbrush 207 can be covered with a thin sheet of plastic material 222 which is selected to give color and finish qualities which are most desirable.

Referring to Figures 15 and 16, a molding process for fabricating a toothbrush 207 is shown. A mold 229 is provided having an upper half 230 and a lower half 232. The mold has an upper injector 234 which is fitted material from a tank 236 containing plastic material 222. The injector 234 is also associated with a blower 238 utilized for injecting pressurized air into the mold cavity 240 when the mold halves are closed (Figure 16). Stiffeners 214, 216 and 218 are placed within the mold chamber and are positioned by appropriate fixtures 242. Upon closure of the mold halves 230 and 232 together, plastic material 222 will be inserted into the mold cavity 240 by the injector 234. Injector 234 will also deliver pressurized air provided by blower 238 into the mold chamber 240 causing the plastic material 222 to form a lining or outer coating for the toothbrush. After an appropriate cure period, wherein after the molds halves 230 and 232 can be appropriately heated or cooled, an injector 244 will inject into the mold the plastic material 220 which is held in a tank 246. Again, after an appropriate cure time, the toothbrush head 208, neck 210 and handle 207 will be formed and then removed from the mold halves 230, 232 which are then separated from one another.

Referring to Figure 17, a mold 330 is provided to form a tooth brush which is fabricated from two polymeric materials having varying flexure modulus. The first plastic material 332 which is generally rigid is contained within a tank 334. Tank 334 is connected by a line 336 with a toothbrush handle injector 338. Tank 334 is connected with a line 340 which is also connected with a head injector 342 and neck injectors 344 and 346. A plastic material 350 is provided in a tank 352. Tank 352 by line 354 is connected with an injector 356. Tank 352 by line 358 is connected with an injector 360. The mold 330 has an upper half 362 and a lower half 364 which are brought together. The upper half of the mold 330 has a line 366 connected with a blower 368. In operation the mold halves 362 and 364 are brought together forming a mold chamber 370. A controller (not shown) is utilized to control and sequence the injectors 338, 346, 356, 360, 344, 342. The controller also turns on the blower 368 to pressurize the mold cavity 370 via the line 366. The controller will then cause the injectors 338 and 342 either simultaneously or sequentially to inject the material 332 to form a handle 113 and a head 115. The pressurization provided by line 366 prevents the high flexure modulus material from invading the neck portion of the mold chamber 370. The controller will also subsequently cause injectors 346, 356, 360 and 344 to form an initial blend of materials from materials 332 and 350. Initially the blend will be mainly from the high modulus material 332, however, subsequently the controller will cause the blend to be gradually switched to an almost 100% blend of the material 350. The result will be that a middle portion of the neck 114 will be the most flexible with the outer portions of the neck progressively being more rigid. Since the materials 332 and 350 are both thermoplastic resins the blend will help prevent delamination between two dissimilar materials to prevent the formation of a mold interface between the materials. The toothbrush 110 can then be taken from the mold and in a different embodiment (not shown) the toothbrush 110 can be provided with an outer coating in a process similar to that aforedescribed and referenced to Figures 15 and 16.

It will be appreciated that the toothbrush of the present invention represents a significant improvement for brushing of teeth having attached orthodontic devices. While a number of specific embodiments of this toothbrush have been disclosed, it will be appreciated that various modifications may be made to this toothbrush without departing from the present invention.